INTERNATIONAL STANDARD

Digital audio – Interface for non-linear PCM encoded audio bitstreams applying IEC 60958 –
Part 16: AVSA

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The text of this International Standard is based on the following documents:

Draft	Report on voting
100/4108/CDV	100/4164/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 61937 series, published under the general title *Digital audio – Interface for non-linear PCM encoded audio bitstreams applying IEC 60958*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,

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- revised.

DIGITAL AUDIO –
INTERFACE FOR NON-LINEAR PCM ENCODED
AUDIO BITSTREAMS APPLYING IEC 60958 –

Part 16: AVSA

1   Scope

This part of IEC 61937 describes the method to convey non-linear PCM bitstreams encoded in accordance with the AVSA format.

2   Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60958 (all parts), *Digital audio interface*

IEC 61937-1:2021, *Digital audio – Interface for non-linear PCM encoded audio bitstreams applying IEC 60958 – Part 1: General*

IEEE Std 1857.8-2020, *IEEE Standard for Second Generation Audio Coding*

GB/T 33475.3, *Information technology – High efficiency media coding – Part 3: Audio*

3   Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61937-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
AVSA frame
audio stream defined in IEEE Std 1857.8 and GB/T 33475.3, where GB/T 33475.3 is an equivalent standard (a Chinese version of IEEE Std 1857.8)

3.2
AVSA BWE frame
AVSA bandwidth extension frame defined in IEEE Std 1857.8 and GB/T 33475.3, where GB/T 33475.3 is an equivalent standard (a Chinese version of IEEE Std 1857.8)

3.3
frame length
number of linear PCM audio samples per AVSA frame

3.4
latency
delay time of an external audio decoder to decode an AVSA audio data-burst defined as the sum of the values of the receiving delay time and the decoding delay time

4 Mapping of the audio bitstream on to IEC 61937-1

4.1 General

The coding of the bitstream and data-burst is in accordance with IEC 61937-1:2021, including field names such as "Pc", "Pa" and "R".

4.2 AVSA burst-info

As all bits are used in the preamble word of Pc, the value of data-type bits 0 to 4 in Pc are set to be 1 Fh and the value of data-type bits 5 to 6 in Pc are set to be 0. The extended data-type burst preamble Pe is used and the value is set to be 0x0001 h. The 32-bit burst-info contains information about the data which will be found in the data-burst (see Table 1).

Table 1 – Fields of burst-info

Data-type Value of Pc bits 0 to 4	Data-type Value of Pc bits 5 to 6	Extended data-type Value of Pe bits 0 to 15	Data-type Value of Pc bits 8 to 9	Contents	Reference point R	Repetition period of data-burst measured in IEC 60958 frames
0x1F	0	0x0001	0	AVSA	bit 0 of Pa	see Table 3
			1	AVSA BWE	bit 0 of Pa	see Table 4
			2 or 3	reserved for future use		
		0x0002 to 0xFFFF	reserved for future use			
	1 to 3	Extended data-type (do not use until defined)				

Bits 0 to 6 of the burst-info (Pc) and bits 0 to 15 of the burst-info (Pe) signal the data-type used for transmission. For AVSA, the signaled extended data-type is 0x0001h.

The Pc bits 8 to 9 indicate the AVSA bitstream mode. The repetition periods of data bursts in IEC 60958 frames shall be determined from the data-type-dependent information specified in Table 3 and Table 4.

5 Format of AVSA data-burst

5.1 General

This clause specifies the AVSA data-burst. Specific properties such as reference points, repetition period, the method of filling stream gaps, and decoding latency are specified.

The decoding latency (or delay), indicated for the data-type, should be used by the transmitter to schedule data-bursts as necessary to establish synchronization between picture and decoded audio.

5.2 Pause data-burst

The pause data-burst for AVSA is given in Table 2.

Table 2 – Repetition period of pause data-burst

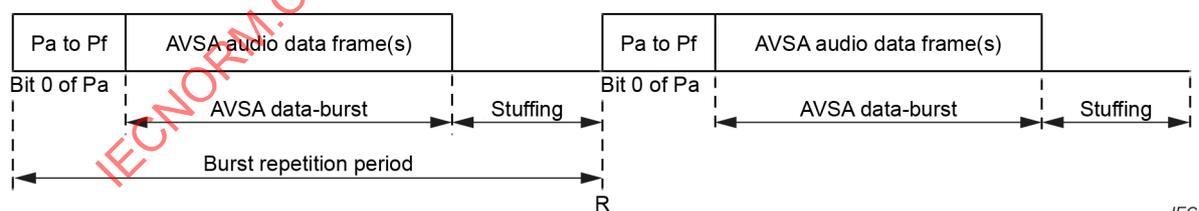| Data-type of audio data-burst	Repetition period of pause data-burst	
	Mandatory	Recommended
AVSA	-	3 IEC 60958 frames
AVSA BWE	-	3 IEC 60958 frames

If regular audio data-bursts are not being transmitted due to, for example, a pause condition, it is recommended to use pause data-bursts to fill such stream gaps. The repetition period of the pause data-bursts should be selected according to Table 2. If other repetition periods are necessary to precisely fill the stream gap length, or to meet the requirement on audio data-burst spacing (see IEC 61937-1), pause data-bursts may have other lengths.

When a stream gap in an audio stream is filled by a sequence of pause data-bursts, the Pa of the first pause data-burst shall occur after exactly that number of IEC 60958 frames as indicated by the AVSA audio data-frame length in conjunction with the data-type-dependent information from Table 4. It is recommended that the sequence of pause data-bursts that fills the stream gap continue from this point until the Pa of the first audio data-burst that follows the stream gap, or as close as possible to that point, considering the specific IEC 60958 frame length of the pause data-burst with respect to the AVSA audio data frame length. The repetition-period-length parameter contained in the pause data-burst is intended to be interpreted by the receiver as an indication of the number of decoded PCM samples that are missing (due to the resulting audio gap).

5.3 Audio data-burst

5.3.1 The AVSA data

An AVSA bitstream consists of a sequence of AVSA frames. The AVSA data-burst is headed with a burst-preamble, followed by the burst-payload. The structure of the AVSA data-burst is shown in Figure 1. The extended data-type Pe bits 0 to 15 of an AVSA data-burst is 0x0001h, and the data-type Pc bits 8 to 9 is 0. When AVSA data is being transmitted, the transmission device shall ensure that both the extended data-type Pe bits 0 to 15 and data-type Pc bits 8 to 9 values are set correctly. Additionally, the receiving device shall utilize both the extended data-type Pe bits 0 to 15 and data-type Pc bits 8 to 9 values to ensure that the content of the data-burst is correctly identified as AVSA.

Figure 1 – AVSA data-burst structure

Table 3 – Data-type-dependent information for AVSA

| Bits of Pc LSB.MSB	Value	Contents	Repetition period of data-burst in IEC 60958 frames
10 and 11	0	AVSA	1 024
	1	AVSA half-rate low sampling frequency	2 048
	2	AVSA quarter-rate low sampling frequency	4 096
	3	reserved for future use	-
12		reserved for future use	

The repetition period of data-bursts in IEC 60958 frames shall be determined from the AVSA audio data frame length in accordance with Table 3 (Pc bits 10-11).

5.3.2 Latency of AVSA decoding

The latency of an external audio decoder to decode AVSA is defined as the sum of the receiving time of one AVSA audio data frame in one or more data-bursts and the time used for decoding of one AVSA audio data frame.

Each data-burst contains a minimum of 4 mandatory fields (Pa, Pb, Pc, and Pd) and extended fields of Pe and Pf of length 16 bits each. The repetition period of data-bursts in IEC 60958 frames is computed according to information from Table 4. The reception delay for one audio access unit is calculated as the time elapsed counting from the first bit of the data-burst until the last bit of the actual audio payload inside the data-burst received. Subsequent stuffing is not considered. After a complete frame is received, immediate decoding and subsequent rendering of the audio frame is not recommended as the size of the next audio frame, and therefore time required for receiving it completely, cannot be determined accurately.

In order to simplify the timing mechanism for receiving and decoding of content of data bursts, the receiving delay should be calculated as the time necessary to receive the complete data-burst including the stuffing. The maximum time available to decode (the decoding delay) should be selected to correspond to the length of one full data-burst. This results in an overall delay corresponding to two complete data-bursts for reception and decoding, as shown in Figure 2.
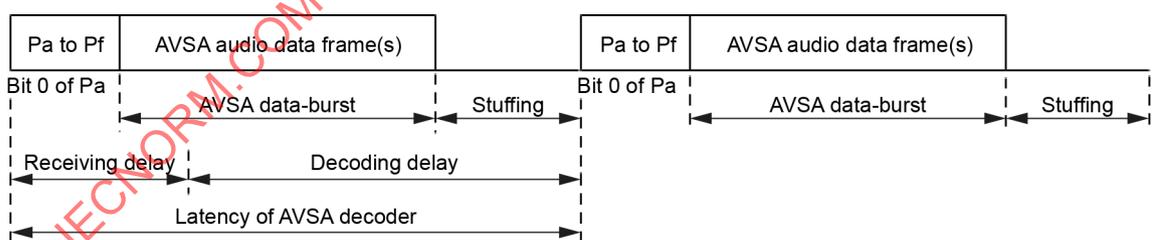
Figure 2 – Latency of AVSA decoding

For example, the maximum length of the whole data payload of AVSA is 6 832 bits for a maximum bitrate of 320 kbit/s. In this case, the maximum length of data bursts is 6 928 bits. The receiving delay is 4,51 ms at a 48 kHz sampling frequency. The decoding delay is 21,33 ms, corresponding to one AVSA frame. Hence, the latency of AVSA decoding is approximately 25,84 ms.

The absolute maximum length of the data-burst is calculated as follows. Each data-burst contains a minimum of 6 stuffing 16-bit words. The repetition period of data-burst is 1 024 IEC 60958 frames. Therefore, the maximum length of data-burst is as follows:

1 024 samples × 2 channels × 16 bits – 6 words × 16 bits = 32 672 bits

The receiving delay time is 21,28 ms at a 48 kHz sampling frequency, which leads to the absolute maximum AVSA decoding latency of 42,61 ms with the decoding delay 21,33 ms as above.

For synchronization (for example with video), the recommended value for latency corresponds to the time necessary to receive two complete data-bursts. A shorter latency may be acceptable if synchronization is not required.

5.3.3   The AVSA BWE data

An AVSA BWE bitstream consists of a sequence of AVSA BWE frames. The AVSA BWE data-burst is headed with a burst-preamble, followed by the burst-payload. The structure of the AVSA BWE data-burst is shown in Figure 3. The extended data-type Pe bits 0 to 15 of an AVSA BWE data-burst is 1, the data-type Pc bits 8 to 9 values equal to 1. When AVSA BWE data is being transmitted, the transmission device shall ensure that both the extended data-type Pe bits 0 to 15 and the data-type Pc bits 8 to 9 values are set correctly. The burst payload of each data-burst of AVSA BWE data shall represent 2 048 samples for each encoded channel.
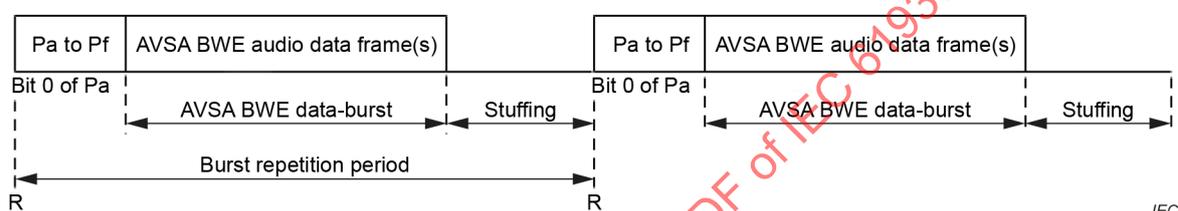

Figure 3 – AVSA BWE data-burst structure

The reference point of the AVSA BWE data-burst is bit 0 of Pa and occurs exactly once every 2 048 sampling periods. The data-burst containing AVSA BWE frames shall occur at a regular rate with the reference point of the first bit of Pa of the first audio data-burst and the first bit of Pa of the next audio data-burst.

It is recommended to use pause data-bursts to fill stream gaps in the AVSA BWE bitstreams. The repetition period of the pause data-bursts is 3 IEC 60958 frames, as shown in Table 2. If other repetition periods are necessary to precisely fill the stream gap length, or to meet the requirement on audio data-burst spacing (see IEC 61937-1), pause data-bursts may have other lengths.

Table 4 – Data-type-dependent information for AVSA BWE

Bits of Pc LSB..MSB	Value	Contents	Repetition period of data-burst in IEC 60958 frames
10 and 11	0	AVSA BWE	2 048
	1	AVSA BWE half-rate low sampling frequency	4 096
	2	AVSA BWE quarter-rate low sampling frequency	8 192
	3	reserved for future use	-
12		reserved for future use	

The repetition period of data-bursts in IEC 60958 frames shall be determined from the AVSA BWE audio data frame length in accordance with Table 4 (Pc bits 10 and 11).